Physics Education as an Interdisciplinary Career and Research Field

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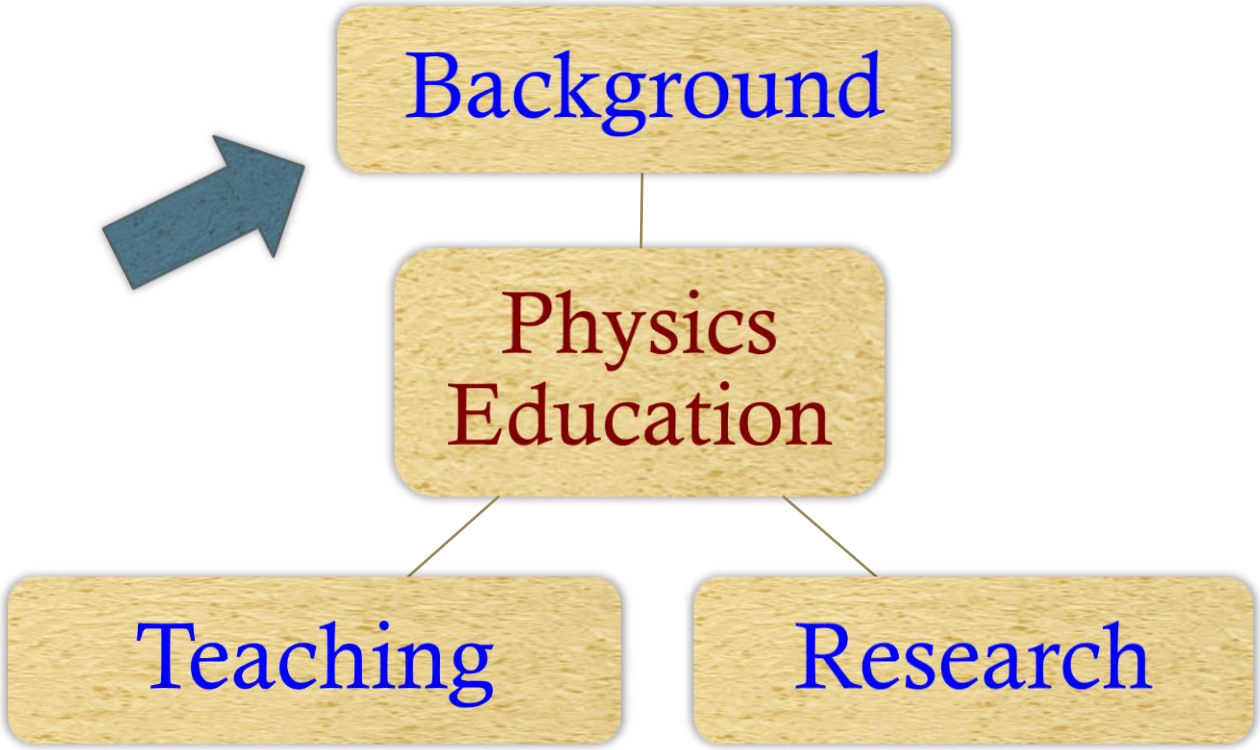
My Pathway to an Interdisciplinary Physics Career



Work-Life-School Transcendence

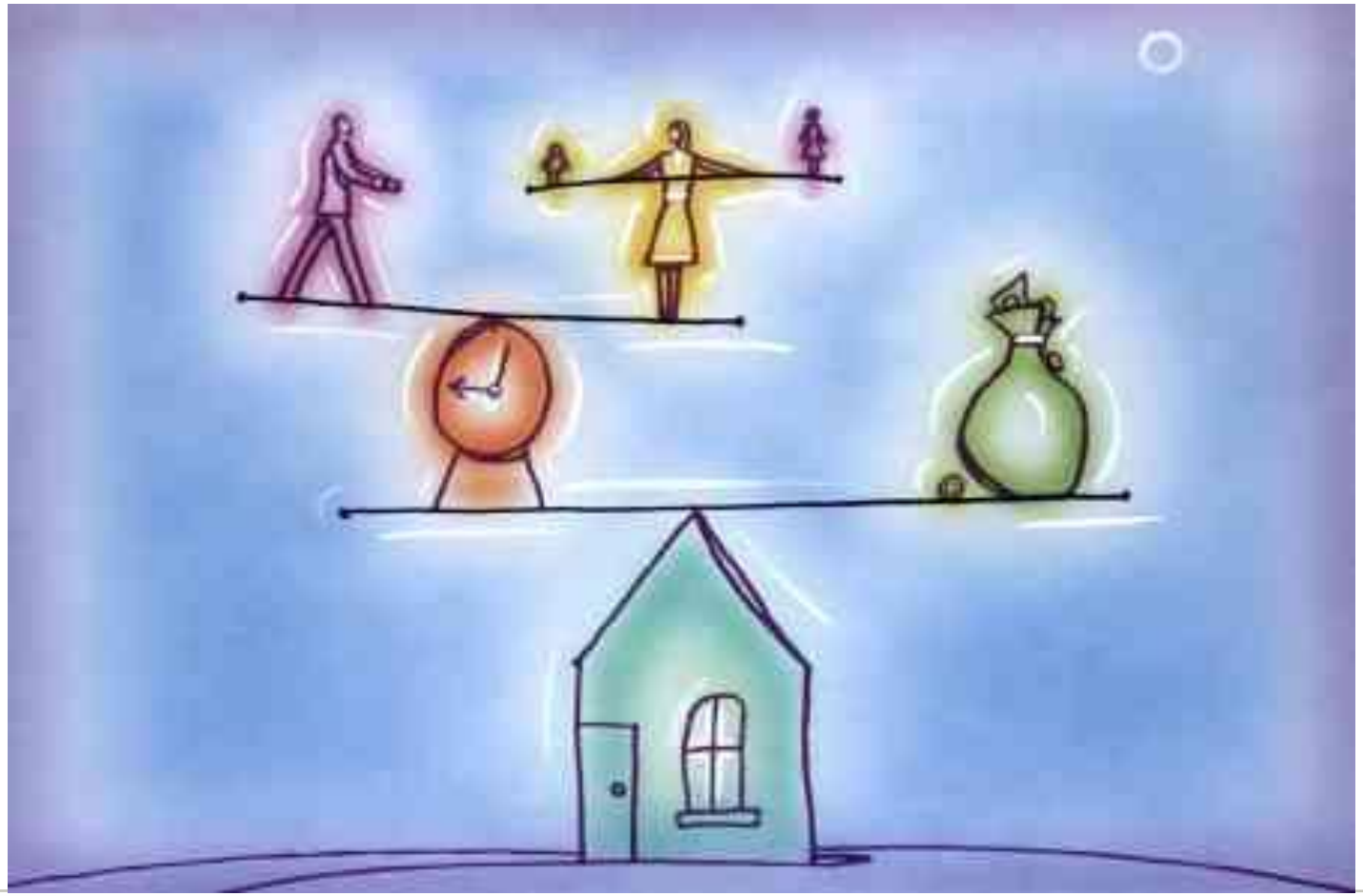
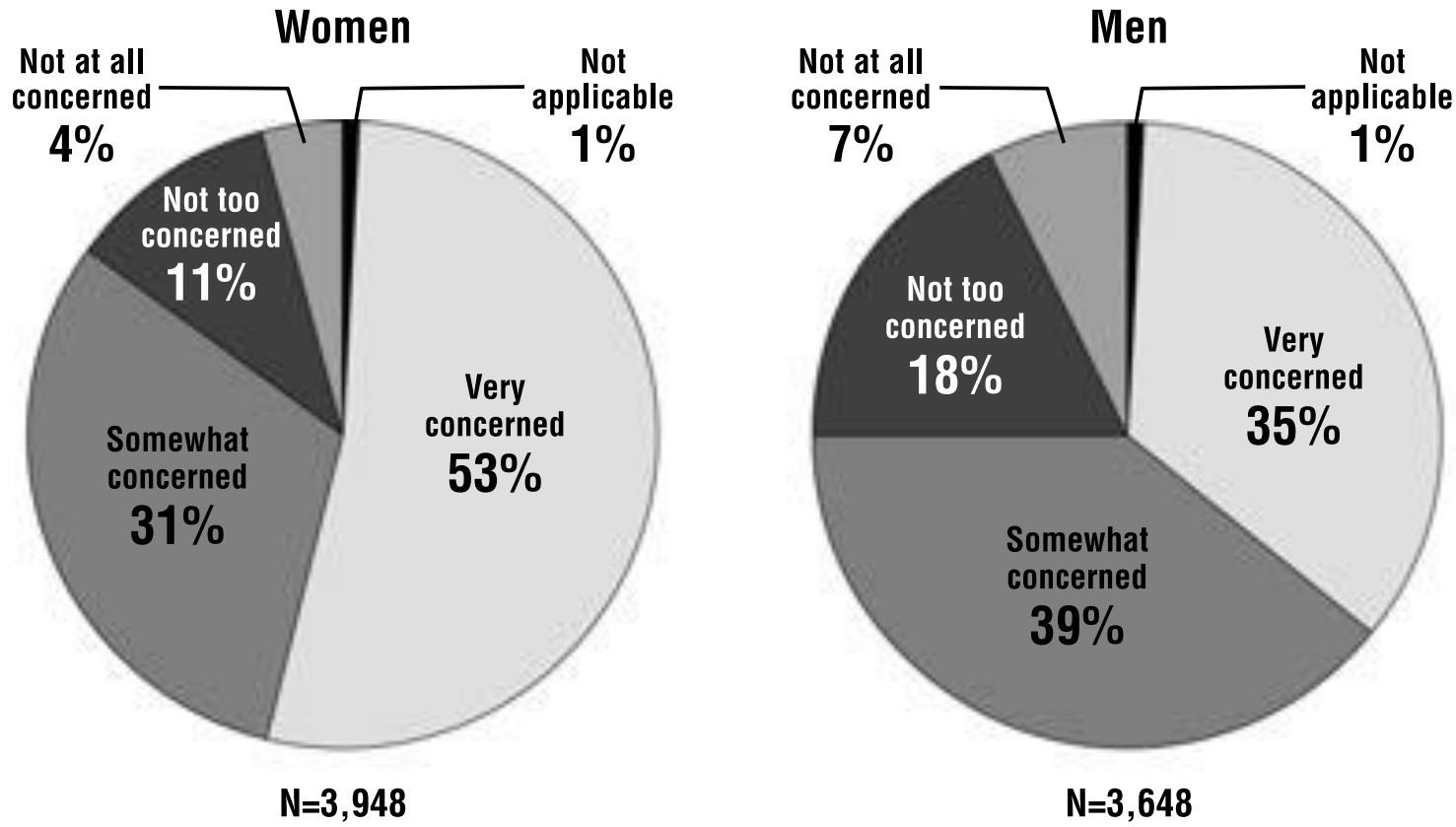


Figure 1
Concern about Family Friendliness

As you think about your future career plans, how concerned are you about the family friendliness of possible career paths?



Source: Mary Ann Mason and Marc Goulden, UC Doctoral Student Career Life Survey (2006), http://ucfamilyedge.berkeley.edu/grad%20life%20survey.html.

Table 1

Reasons Most Commonly Cited for Shifting Career Goal Away from Professor with Research Emphasis

Factor	% Citing as "Very Important" Women	Men
Other life interests	48	35
Issues related to children	46	21
Negative experience as PhD student	46	44
Professional activity too time-consuming	45	35
Geographic location issues	40	28
Feelings of isolation or alienation as PhD student	35	31
Spouse or partner issues or desire to marry	32	22
Bad job market	30	29
Job security	29	29
Career advancement issues	27	34
Other career interests	27	23
Monetary compensation (salary, benefits)	23	31
	N= 550 to 666	**402 to 529**

Shading indicates response rates that are significantly higher among one gender than the other (P<.01).

Source: Mary Ann Mason and Marc Goulden, UC Doctoral Student Career Life Survey (2006), http://ucfamilyedge.berkeley.edu/grad%20life%20survey.html.
Note: Responses of "not applicable" are excluded from this analysis.

Balance Considerations

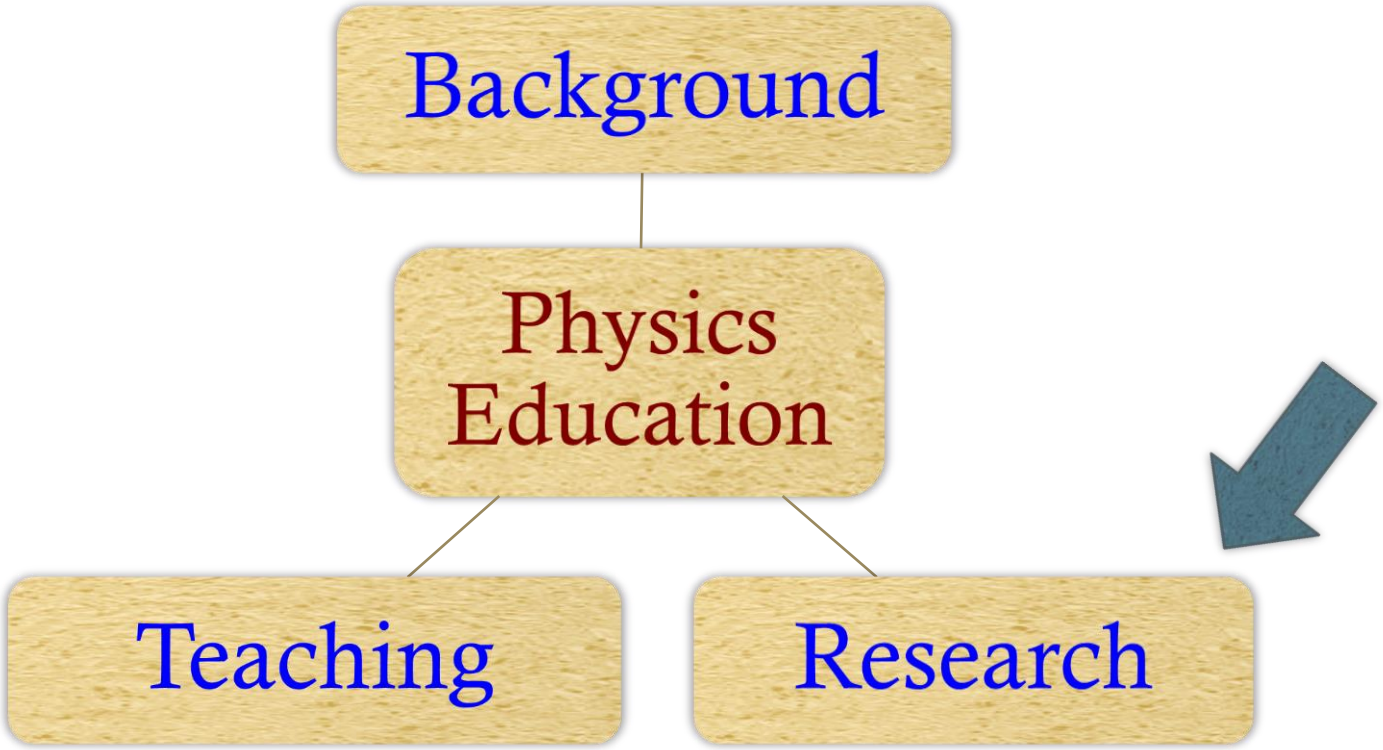
- Lack of balance is not unique to STEM.
- Passion is required for excellence.
- Success requires consistency in output, quality of work, and reliability.
- Many women partake in non-linear career trajectories.
- Choose your employers/colleagues carefully – seek a broadly supportive culture.
- Recognize and value your personal and sociocultural capital.


DONT LET
OTHERS
DEFINE YOU

Some Priceless Questions…

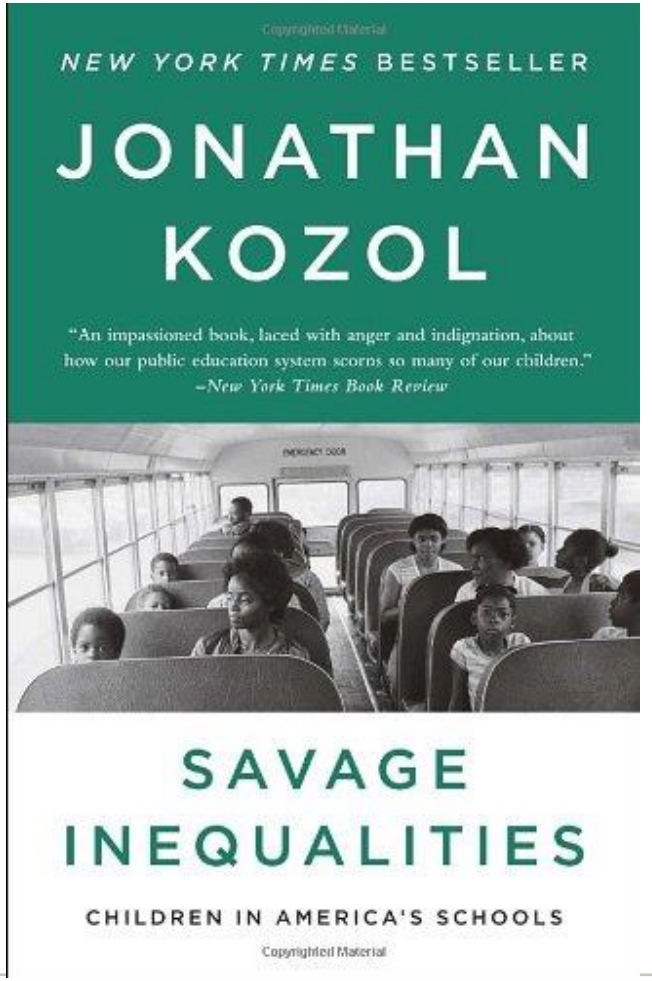
1) "What makes you think you can succeed in graduate school if you have five kids?"
2) "Why is there a four-year gap on your resume? Would you mind telling me what you were doing?"
3) "Do your children all have the same father?"

My Pathway to an Interdisciplinary Physics Career



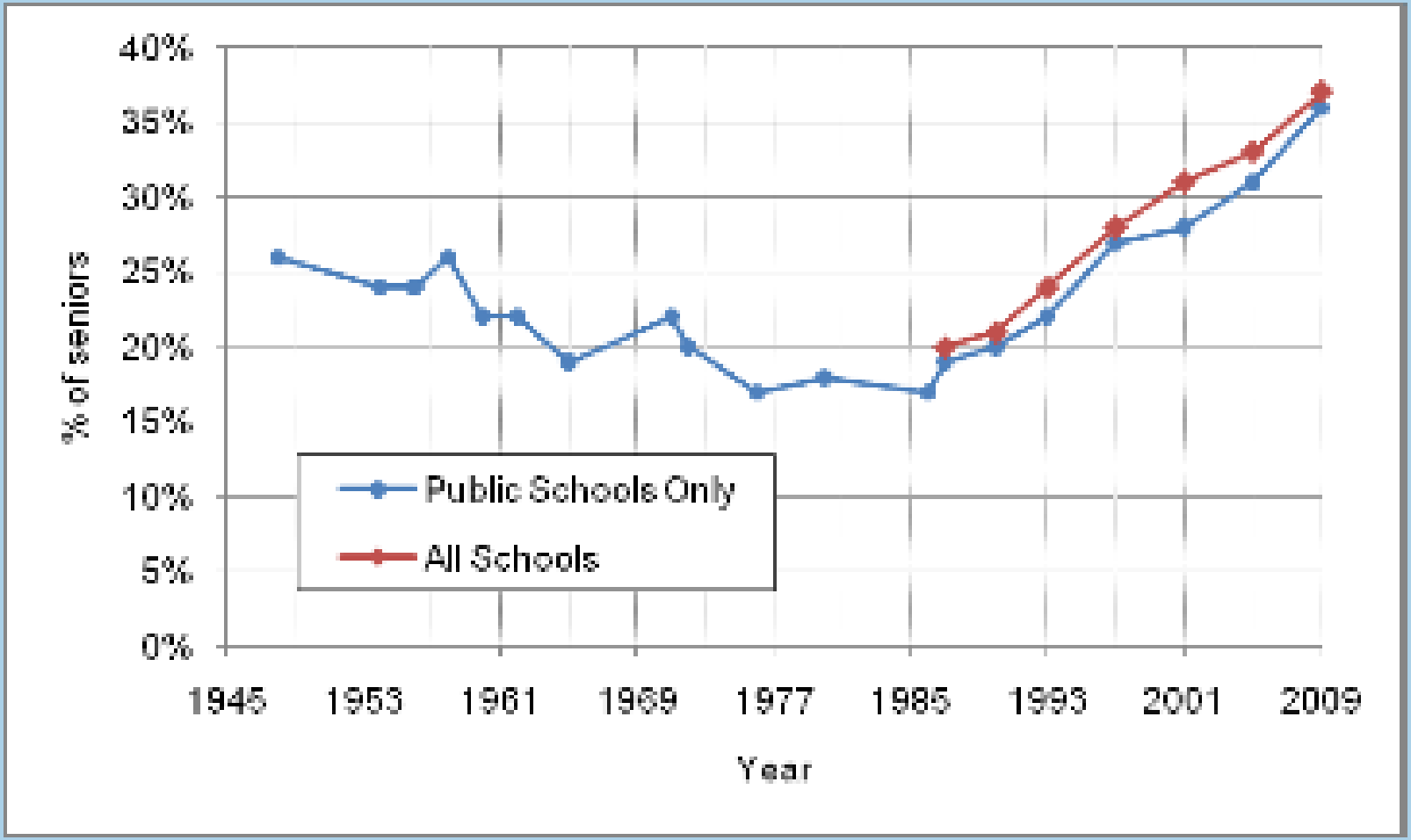
Equity in Physics Education

- Who has access to physics in U.S. secondary schools?
- Does it depend on where you live? Socioeconomic status? Ethnicity?
- How can participation be more equitable?



Physics Enrollment* in U.S. High Schools: 1948 – 2009

*Percent of seniors who have taken at least one physics course prior to graduation

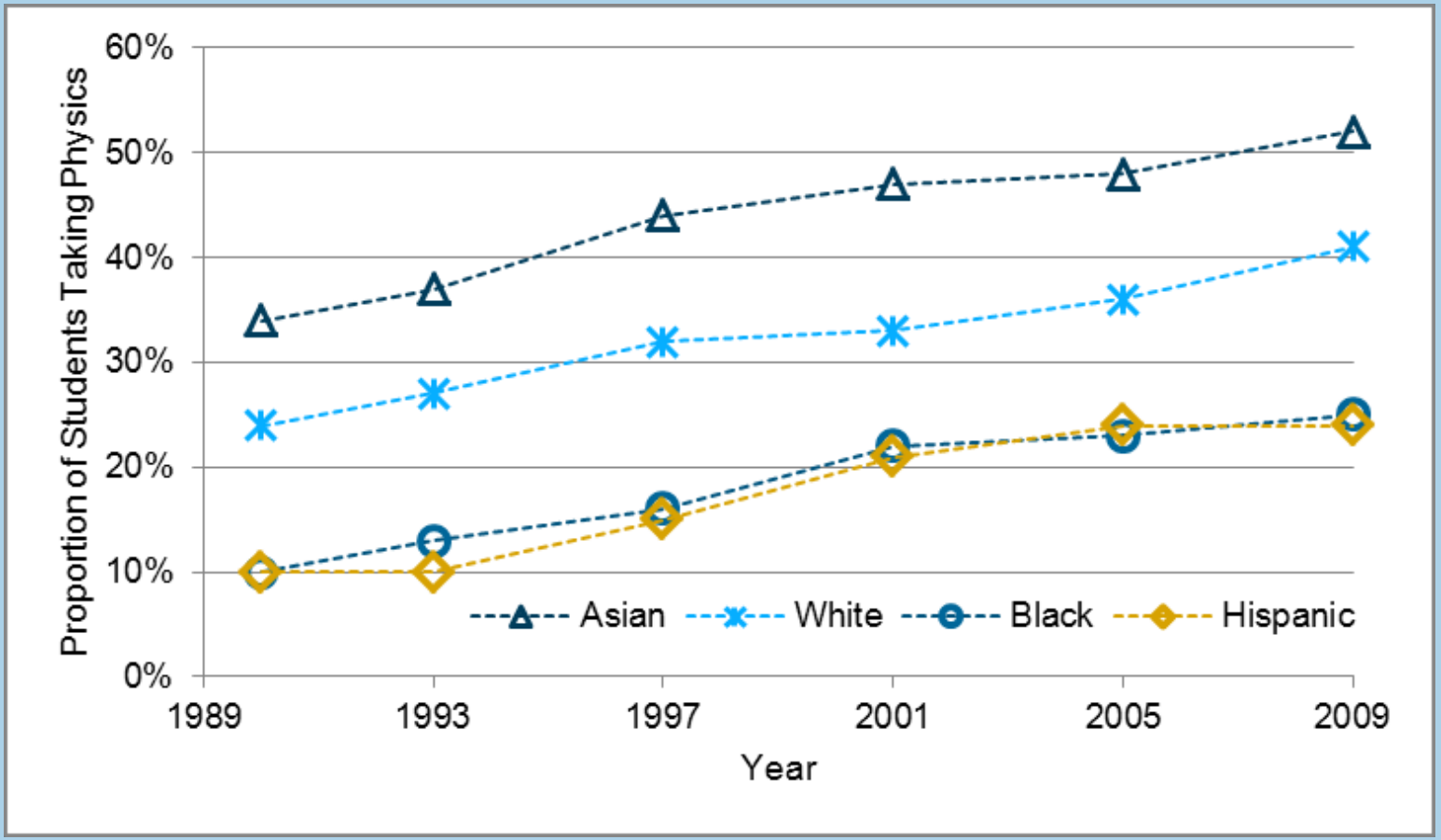


Source: 1987 – current, AIP; data prior to 1987 from NCES

http://www.aip.org/statistics

Proportion of Students in Each Racial or Ethnic Group Taking Physics*

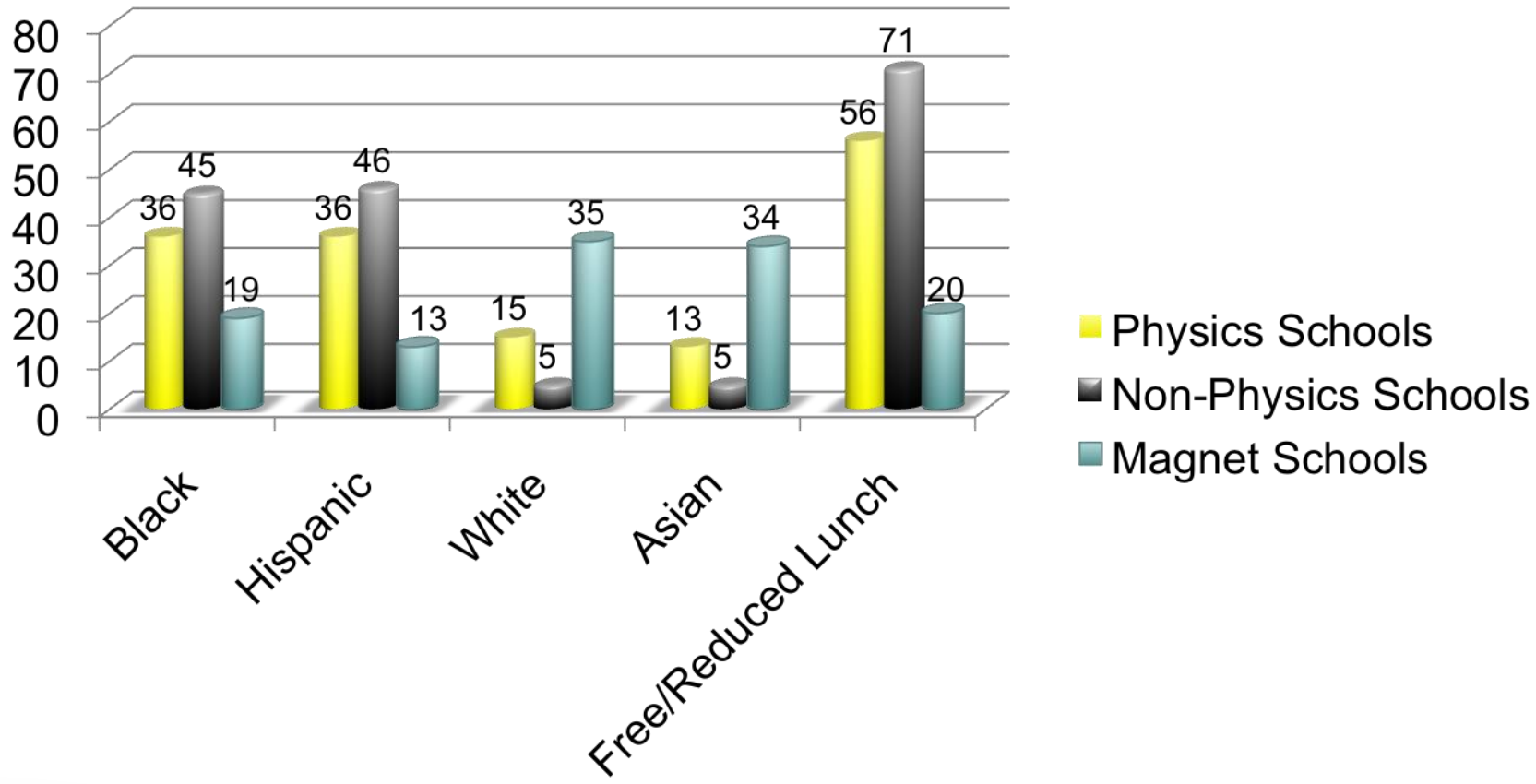
All U.S. High Schools



* **A closer examination of the data reveals that these differences are likely driven more by socioeconomic factors than by race.**

http://www.aip.org/statistics

NYC High School Demographics (2006-07)



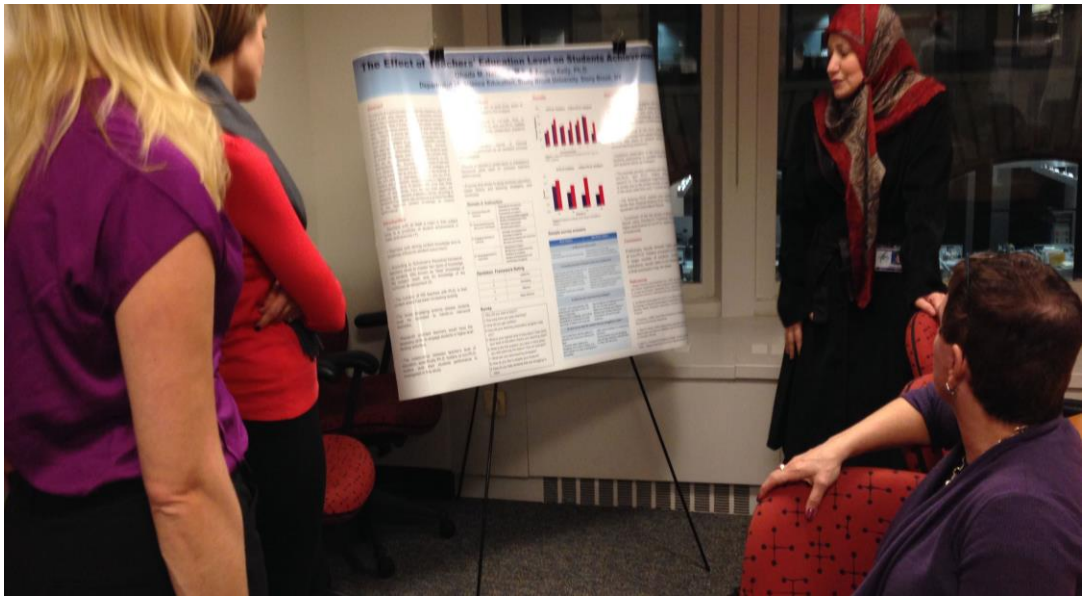
How Can the Problem Be Solved?

- Transparency in data
- Working with school administrators and teachers
- Networking and mentoring opportunities
  - Bronx Institute
  - NSBP, NSHP
  - SUNY STEM Mentoring Initiative
  - Informal education experiences (AMNH, Engineering)
- Improving undergraduate STEM teaching and learning

Bronx Institute

- Saturday/Summer Physics Academy
- Grades 8-11
- Hands-on, inquiry-based physics learning

Ph.D. Program in Science Education



Center for **Science** + **Mathematics** Education

STONY BROOK UNIVERSITY

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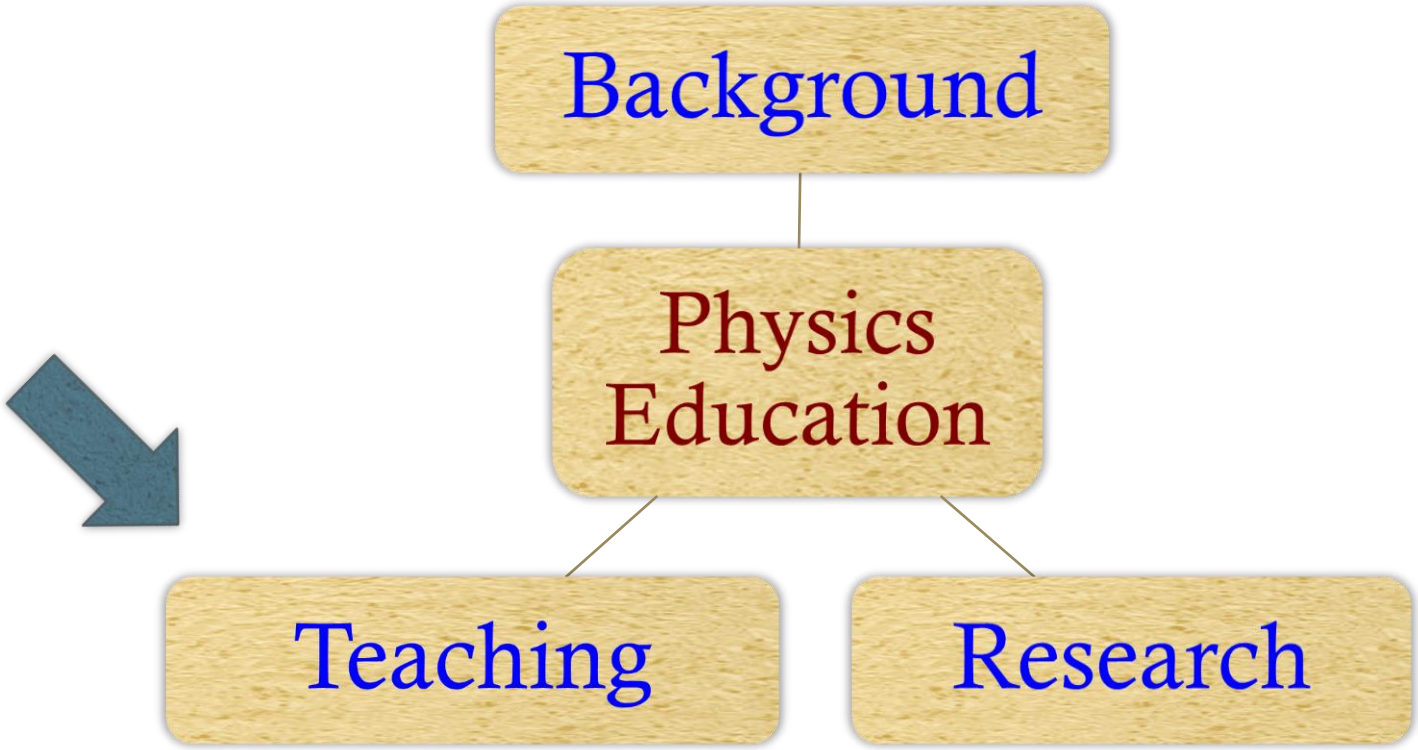


Research on STEM Retention "Engage to Excel"

- Fewer than 40% of STEM majors complete a STEM degree.
- The first 2 years of college are critical for STEM recruitment and retention.
- Recommendations:
  - Catalyze widespread adoption of empirically validated teaching practices.
  - Advocate and provide support for replacing traditional courses with discovery-based research courses.

Executive Office of the President

The President's Council of Advisors on Science and Technology

MIT TEAL

"Technology Enhanced Active Learning"

TABLE 1

Percentage of students who switch out of STEM majors, by pedagogy and by gender (N_{trad} = 101; N_{PI} = 997).

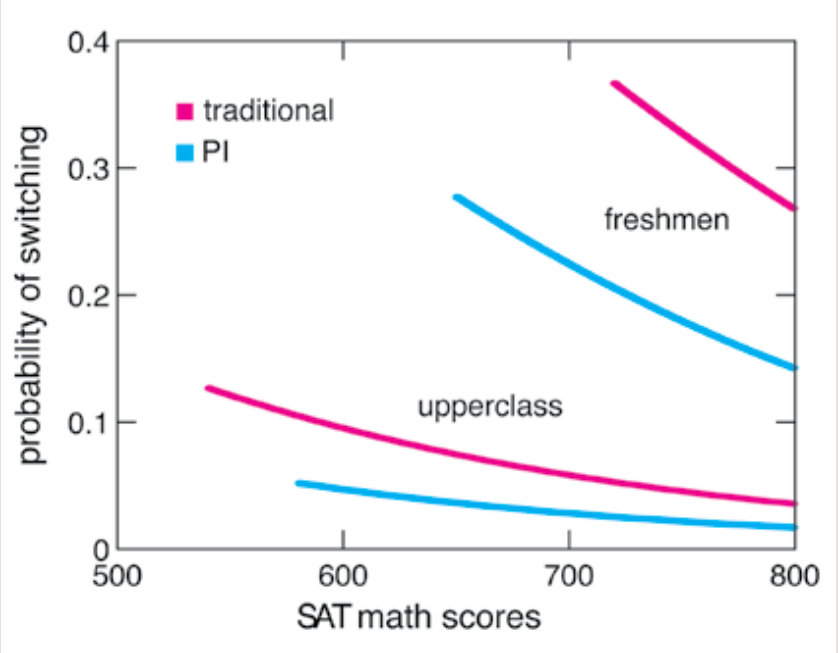
Instruction	Total	Male	Female
Traditional	0.11	0.11	0.10
PI	0.05	0.06	0.05

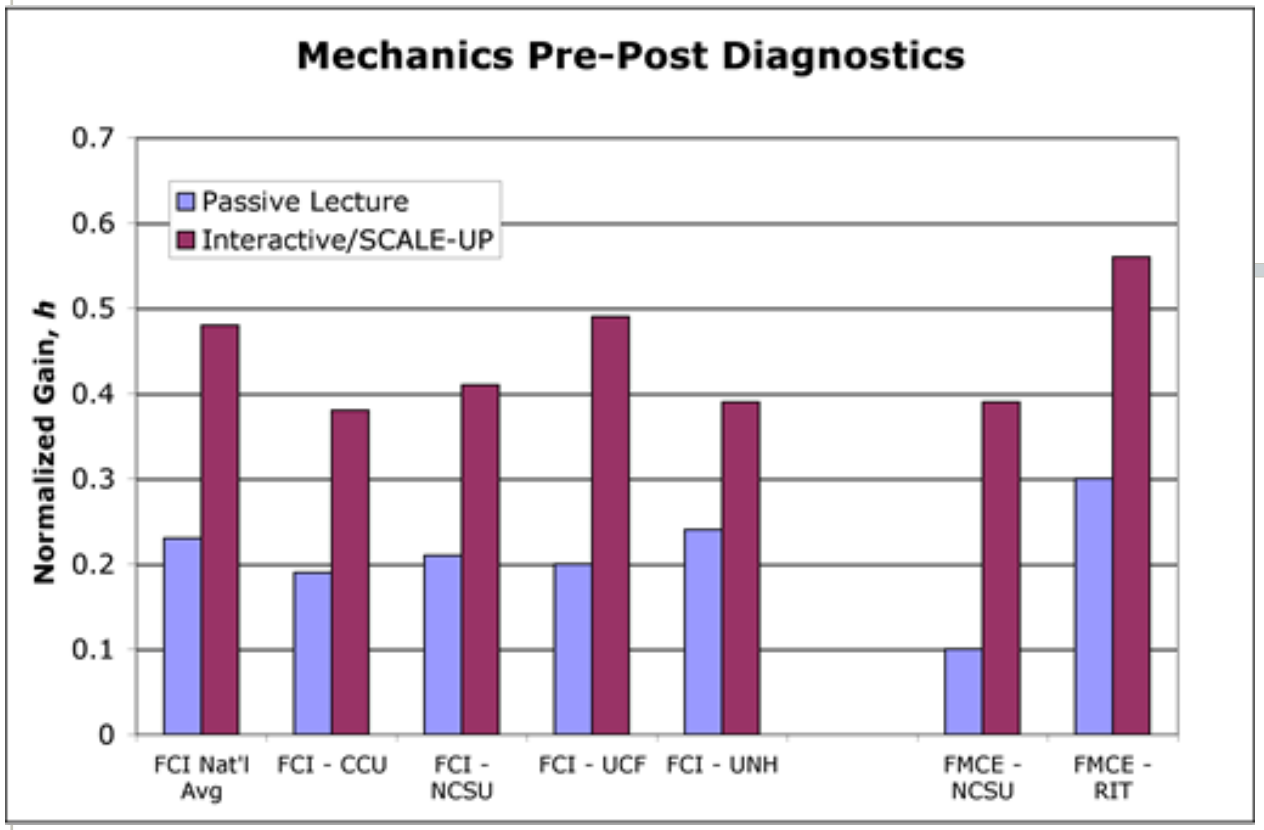
Note: PI = Peer Instruction.

Watkins & Mazur, *JCST,* 2013.

FIGURE 3

Probability that a student will switch out of STEM majors, by pedagogy, year in school, and SAT math scores. PI = Peer Instruction.





NC State SCALE-UP Assessment

	Lecture/Lab	SCALE-UP
# Classes	2	6
# Students	188	342
% Attendance	74.3	90.3
Standard Deviation	24.3	11.6

NC State SCALE-UP Retention

$$\text{Failure rate ratio} = \frac{\%\ \text{failing in traditional class}}{\%\ \text{failing in SCALE-UP}}$$

Group	# Students (Traditional)	# Students (SCALE-UP)	Failure Rate Ratio
Overall	14804	1150	2.8
Male	11473	888	2.5
Female	3331	262	**4.7**
White	12009	922	2.8
Native American	109	23	3.8
African American	1361	114	**3.5**
Asian American	1026	65	2.1
Hispanic	299	25	No S-UP failures

Concluding Thoughts

- The career path does not have to be straight and narrow.
- Be creative in constructing the quality of life you desire.
- Networking and mentoring are essential.
- Don’t let others define you.